

FORM PTO-1390 (Modified) (REV 10-95)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 1974	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR) <b>10/070088</b>	
INTERNATIONAL APPLICATION NO. <b>PCT/DE 00/03056</b>		INTERNATIONAL FILING DATE <b>SEPTEMBER 5, 2000</b>		PRIORITY DATE CLAIMED <b>SEPTEMBER 7, 1999</b>	
TITLE OF INVENTION <b>METHOD FOR ENCODING AND DECODING OBJECTS WITH REFERENCE TO A TRAFFIC ROUTE NETWORK</b>					
APPLICANT(S) FOR DO/EO/US <b>Bernd PETZOLD, Bernd HESSING, Cornelius HAHLOWEG, Gerd DRAEGER, Ulrich-KERSKEN, Peter KREFT, Jan MARTIN</b>					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2))           <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li>7. <input type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).</li> <li>8. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))           <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>9. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>10. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).</li> <li>11. <input type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).</li> <li>12. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).</li> </ol>					
<b>Items 13 to 18 below concern document(s) or information included:</b>					
<ol style="list-style-type: none"> <li>13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>15. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment. A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li>16. <input type="checkbox"/> A substitute specification.</li> <li>17. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>18. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail</li> <li>19. <input type="checkbox"/> Other items or information:</li> </ol>					
<p style="font-size: 2em; font-family: cursive;">ET 796689380 US</p>					

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <div style="font-size: 1.5em; font-weight: bold;">10/070088</div>		INTERNATIONAL APPLICATION NO. <div style="font-weight: bold;">PCT/DE 00/03056</div>		ATTORNEY'S DOCKET NUMBER <div style="font-weight: bold;">1974</div>	
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20. The following fees are submitted: <b>BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5)) :</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 80%;"> <input type="checkbox"/> Search Report has been prepared by the EPO or JPO .....  <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) .....  <input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) .....  <input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....  <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) .....           </div> <div style="width: 15%; text-align: right;"> <div>\$930.00</div> <div>\$720.00</div> <div>\$790.00</div> <div>\$1,070.00</div> <div>\$98.00</div> </div> </div> <div style="text-align: center; margin-top: 10px;"> <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b> </div>				<b>CALCULATIONS PTO USE ONLY</b>  <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				<div>\$0.00</div>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	19 - 20 =	0	x \$18.00	\$0.00	
Independent claims	2 - 3 =	0	x \$80.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$890.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). <input type="checkbox"/>				\$0.00	
<b>SUBTOTAL =</b>				\$890.00	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
<b>TOTAL NATIONAL FEE =</b>				\$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
<b>TOTAL FEES ENCLOSED =</b>				\$890.00	
				Amount to be: refunded	\$
				charged	\$

☐ A check in the amount of \_\_\_\_\_ to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **19-4675** in the amount of **\$890.00** to cover the above fees.  
 A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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**MICHAEL J. STRIKER**  
 NAME  
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 REGISTRATION NUMBER  
**MARCH 4, 2002**  
 DATE

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:                      Group:                      Attorney Docket # 1974

Applicant(s) :    PETZOLD, B., ET AL

Serial No.        :

Filed             :

For                :    METHOD FOR ENCODING AND DECODING  
                      OBJECTS WITH REFERENCE TOA TRAFFIC ROUTE  
                      NETWORK

SIMULTANEOUS AMENDMENT

March 4, 2002

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

S I R S:

Simultaneously with filing of the above identified application  
please amend the same as follows:

In the Claims:

Cancel all claims without prejudice.

Substitute the claims attached hereto.


REMARKS:

This Amendment is submitted simultaneously with filing of the above identified  
application.

With the present Amendment applicant has amended the claims so as to eliminate  
their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,



Michael J. Striker  
Attorney for Applicant(s)  
Reg. No. 27233

## Claims

1. A method for encoding objects with reference to a  
5 traffic route network, wherein the encoded information can also  
be decoded with the aid of databases that differ from a database  
used in the encoding, characterized in that the objects are  
provided with relationships to at least one relational object  
which is present in databases that are used for the decoding, and  
10 the relationships do not primarily result from the traffic route  
network.

2. The method of claim 1, characterized in that  
relationships are indicated parallel to a plurality of relational  
15 objects.

3. The method of claim 1 [or 2], characterized in that  
relationships are indicated hierarchically to a plurality of  
relational objects.

4. The method of [one of the foregoing claims] claim 1,  
characterized in that the relationships are local indications.

5. The method of [one of claims 1-3] claim 1 ,  
25 characterized in that the relationships include logical  
characteristics, in particular memberships.

6. The method of [one of the foregoing claims] claim 1,  
characterized in that the information encoded for a respective  
30 object (reference object) has the following data structure:

<reference object>

<reference/relational object 1>  
    <reference/relational object 11>  
    <reference/relational object 12>  
    ...

5       <reference/relational object 2>  
        ...

        <relational object N>, wherein at least the reference  
object and one relational object are present.

10       7. The method of claim 6, characterized in that in each  
case an object with the following data structure is encoded:  
<reference/relational object>:=

        <plane>  
15       <object type>  
        <object coordinates> <object end>.

        8. The method of claim 7, characterized in that the data  
structure is supplemented with further information, in particular  
20       for outputting the object.

        9. The method of [one of claims 6-8] claim 6,  
characterized in that data which identify a decoding rule are  
associated with at least the data of the reference object, and  
25       that as needed, data that identify a decoding rule are each  
associated with the data of the relational objects.

        10. The method for decoding objects encoded by the method  
of one of the foregoing claims, characterized in that the at  
30       least one relational object is searched for in the database used  
for the decoding, and thereupon the relationship for the object  
to be decoded is evaluated.

11. The method of claim 10, characterized in that search windows are opened around the locations of the relational objects and the reference objects.

5           12. The method of [one of claims 10 or 11] claim 10, characterized in that the at least one relational object is searched for in at least one further database, if it is not found in the database intrinsically used for the decoding.

10           13. A method for encoding objects with reference to a traffic route network, wherein the encoded information can also be decoded with the aid of databases that differ from a database used in the encoding, wherein the encoding includes at least one position indication, characterized in that the at least one  
15 position indication is provided with a position type designator.

14. The method of claim 13, characterized in that the position type designator indicates whether the position indication pertains to an exact position and/or indicates the  
20 location of a search space for a position or an object.

15           15. The method of [one of claims 13 or 14] claim 13, characterized in that the position type designator is valid for one position indication at a time.

25           16. The method of [one of claims 13 or 14] claim 13, characterized in that the position type designator is valid for a plurality of position indications.

30           17. The method of [one of claims 13-16] claim 13, characterized in that the position type designator has at least one attribute, which designates further properties of the

position indication.

18. The method of claim 17, characterized in that the further properties are an error radius of the position  
5 indication.

19. The method of claim 17, characterized in that the at least one attribute indicates whether the position indication is absolute or relative.

## Claims

1. A method for encoding objects with reference to a  
5 traffic route network, wherein the encoded information can also  
be decoded with the aid of databases that differ from a database  
used in the encoding, characterized in that the objects are  
provided with relationships to at least one relational object  
10 which is present in databases that are used for the decoding, and  
the relationships do not primarily result from the traffic route  
network.

2. The method of claim 1, characterized in that  
15 relationships are indicated parallel to a plurality of relational  
objects.

3. The method of claim 1, characterized in that  
relationships are indicated hierarchically to a plurality of  
20 relational objects.

4. The method of claim 1, characterized in that the  
relationships are local indications.

5. The method of claim 1, characterized in that the  
25 relationships include logical characteristics, in particular  
memberships.

6. The method of claim 1, characterized in that the  
information encoded for a respective object (reference object)  
30 has the following data structure:

<reference object>

<reference/relational object 1>  
    <reference/relational object 11>  
    <reference/relational object 12>  
    ...

5       <reference/relational object 2>  
        ...

        <relational object N>, wherein at least the reference  
object and one relational object are present.

10       7. The method of claim 6, characterized in that in each  
case an object with the following data structure is encoded:  
<reference/relational object>:=

        <plane>  
15       <object type>  
        <object coordinates> <object end>.

        8. The method of claim 7, characterized in that the data  
structure is supplemented with further information, in particular  
20       for outputting the object.

        9. The method of claim 6, characterized in that data which  
identify a decoding rule are associated with at least the data of  
the reference object, and that as needed, data that identify a  
25       decoding rule are each associated with the data of the relational  
objects.

        10. The method for decoding objects encoded by the method  
of one of the foregoing claims, characterized in that the at  
30       least one relational object is searched for in the database used  
for the decoding, and thereupon the relationship for the object  
to be decoded is evaluated.

11. The method of claim 10, characterized in that search windows are opened around the locations of the relational objects and the reference objects.

5        12. The method of claim 10, characterized in that the at least one relational object is searched for in at least one further database, if it is not found in the database intrinsically used for the decoding.

10        13. A method for encoding objects with reference to a traffic route network, wherein the encoded information can also be decoded with the aid of databases that differ from a database used in the encoding, wherein the encoding includes at least one position indication, characterized in that the at least one  
15        position indication is provided with a position type designator.

14. The method of claim 13, characterized in that the position type designator indicates whether the position indication pertains to an exact position and/or indicates the  
20        location of a search space for a position or an object.

15. The method of claim 13, characterized in that the position type designator is valid for one position indication at a time.

25        16. The method of claim 13, characterized in that the position type designator is valid for a plurality of position indications.

30        17. The method of claim 13, characterized in that the position type designator has at least one attribute, which designates further properties of the position indication.

18. The method of claim 17, characterized in that the further properties are an error radius of the position indication.

5 19. The method of claim 17, characterized in that the at least one attribute indicates whether the position indication is absolute or relative.

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JC19 Rec'd PCT/PTO 04 MAR 2002

METHOD FOR ENCODING AND DECODING OBJECTS WITH REFERENCE TO A  
TRAFFIC ROUTE NETWORK

The invention relates to methods for encoding and  
decoding objects with reference to a traffic route network,  
5 wherein the encoded information can also be decoded with the  
aid of databases that differ from a database used for the  
encoding.

In traffic telematic applications, in which location-  
specific data are to be exchanged between a transmitter and a  
10 receiver, methods for location referencing - also called  
location encoding - are needed. Methods are employed that  
describe the location references for the data to be sent in  
the database of the transmitter, and methods that evaluate  
the location references of the transmitted data in the  
15 receiver. The evaluation involves interpreting the location  
references and copying them onto the database of the  
receiver. The description of the location references must be  
done such that correct copying of the objects by recognizing  
the location references in the database of the receiver is  
20 possible.

Among others for various applications in traffic  
telematics (such as TMC, GATS), it is known for a description  
form for location references (also called location encoding)  
to be standardized. In these applications, as a rule it is a  
25 condition that the described locations be present in both the  
databases of the transmitter and of the receiver and that  
they have the same location encoding. In the event of  
deviations, calibration of the databases is required.

Methods for referencing elements from a digital map are

also known, which with respect to location encoding have as a prerequisite only similar databases or digital maps with similar digitization. The description of the location references is done on the basis of geographical location  
5 coordinates and other descriptive characteristics. For intersections, as elements of the digital map, certain rules are also defined, which determine the location coordinates and characteristics to be transmitted (German Patent Disclosure DE 197 50 786 A1).

10 The term "objects" is understood in the present connection to mean information with a geographic reference, including multimedia objects such as video sequences, stationary images, or sounds, and/or elements of a digital map.

15 With the invention, the intent is that it be possible for already existing objects in the receiver database to be addressed, new objects to be placed in the receiver database, and existing objects to be modified.

20 Against the background of efforts in search of a universal interface between databases of different map publishers, which naturally applies to partial networks to be transmitted as well, the problem arises of copying the given data sets onto one another, or in other words finding unambiguous associations among the corresponding elements.

25 However, because of publisher-dictated attribution with regard to both the location coordinates and the "heuristic", descriptive characteristics, the result is indefiniteness, which makes unambiguous identification of the encoded object difficult.

In general, the construction of databases is oriented to the type of objectively given linkage of its objects. In the case of digital maps, this is a linkage by way of the neighborhood relationships that exist on the basis of direct street connections.

In mathematical terms, what this means is: Since only the intersection of the attributes used in each of the two databases can be used for comparison purposes, the number of characteristics used for the "pair" identification cannot be greater than the number of attributes that the database, with a low density of characteristics, furnishes per object. The extreme case is then the absence of a corresponding object in the comparison database; in that case, the intersection quantity equals zero.

The object of the invention is therefore to provide each object in a targeted way with attributes, without having to rely on the relationships defined by the road network and thus on the structure of the comparison database.

In a first version of the invention, this object is attained in that the objects are provided with relationships to at least one relational object which is present in databases that are used for the decoding, and the relationships do not primarily result from the traffic route network.

In the method of the invention, application-independent descriptions of location references can be generated between objects and interpreted. This makes possible the exchange of location-specific objects between a transmitter and a receiver of these objects, independently of how the location references in the particular database are embodied. The

databases can be digital maps (for instance in navigation systems) with the same or different detail and geographic coverage.

5 In a receiver, the encoded object can be detected unambiguously even without evaluation of the relationships to the relational object, and the relational object is detected by means of these relationships and incorporated for instance into the receiver database; the invention does not preclude this.

10 In many cases, decoding will already be possible when at least one relational object is indicated. However, to achieve greater versatility of databases and objects, in refinements of the invention it is provided that relationships are indicated parallel and/or hierarchically to  
15 a plurality of relational objects.

In a first feature of the invention, it can be provided that the relationships are local indications. By way of example, these local indications can be coordinate differences or can comprise distance and direction.

20 In a second feature of the invention, it is provided that the relationships include logical characteristics, in particular memberships. For instance, a membership exists between the parking lot and the bus or other public transportation stop, in the case of park-and-ride lots.

25 Preferably in the method of the invention, the information encoded for a respective object (reference object) has the following data structure:

<reference object>

<reference/relational object 1>  
     <reference/relational object 11>  
     <reference/relational object 12>  
     ...

5       <reference/relational object 2>  
        ...

    <relational object N>, wherein at least the reference  
 object and one relational object are present.

10       Preferably, in each case an object with the following  
 data structure is encoded: <reference/relational object>:=

    <plane>  
     <object type>  
     <object coordinates>  
 <object end>.

15       The term "plane" indicates the hierarchical plane, for  
 instance with reference to the aforementioned data structure,  
 regardless of whether this involves the relational object 1  
 or 2 on the one hand or the relational object 11 or 12 on  
 the other.

20       As needed, the data structure of an object can be  
 supplemented with further information, for instance for  
 outputting the object.

25       In a refinement of the method of the invention, it is  
 provided that data which identify a decoding rule are  
 associated with at least the data of the reference object,  
 and that as needed, data that identify a decoding rule are  
 each associated with the data of the relational objects.

Such a need exists for instance if a relational object is to be decoded by a different decoding rule from the reference object.

5 In the sense of this refinement, examples of the decoding rules can be:

- the size of the search window;

10 - the object focus; that is, in addition to the search function, it should also be assured that the coordinate is located inside the outlines of the object, such as a parking lot;

15 - exact position of the information; that is, besides the search function, this information should correspond to an exact position at which, by definition, the plumb line should be dropped onto the object found in the search window, such as the beginning of a traffic jam between two interchanges of an Autobahn (found object).

20 For the search window, it is also true that its size should depend on the object type and can be specified by the transmitter via the further data field in stages, in order to limit the maximum search radius. For instance, given suitable quantization, with 3 bits it is possible to encode a radius of from 10 m to 10 km.

25 In a method for decoding, it is provided according to the invention that the at least one relational object is searched for in the database used for the decoding, and thereupon the relationship for the object to be decoded is evaluated. It is preferably provided that search windows are opened around the locations of the relational objects and the

reference objects.

In a refinement of the method for decoding, the at least one relational object is searched for in at least one further database, if it is not found in the database  
5 intrinsically used for the decoding. It is thus possible to utilize a total of several databases for decoding - such as the database of a TMC receiver and the database (digital road map) of a navigation device.

10 Since in the encoding of location-specific objects, position indications (location coordinates) almost always form the basis for the data formats, but the function of the coordinates can certainly differ, problems can arise in the decoding in the receiver.

15 In a second embodiment of the invention, these problems can be solved by providing that the at least one position indication is provided with a position type designator. For instance, it can be provided that the position type designator indicates whether the position indication pertains to an exact position and/or indicates the location of a  
20 search space for a position or an object.

In this connection, the term "exact" is understood to mean a position, in contrast to a search space. It is also possible for a position to be exact and at the same time to indicate the location of a search space. This can occur for  
25 instance in encoding the beginning of a traffic jam on an Autobahn, where the position, because different coordinate systems are used, is not located on the Autobahn, and the Autobahn is ascertained by a search in the search space around the transmitted position, and then a plumb line is  
30 dropped onto the Autobahn in order to find the beginning of

the traffic jam.

It can certainly happen, in encoding location-specific objects, that an object will include a plurality of position indications, and it can therefore be provided within the scope of the invention that the position type designator is valid for one position indication at a time, or that the position type designator is valid for a plurality of position indications.

It is also possible with the invention for further information for indicating position be encoded with a refinement, in that the position type designator has at least one attribute, which designates further properties of the position indication. Among other things, it can be provided that the further properties are an error radius of the position indication, and/or that the at least one attribute indicates whether the position indication is absolute or relative.

Exemplary embodiments of the invention are shown in the drawing in multiple figures and explained in further detail in the ensuing description. Shown are:

Fig. 1, a block circuit diagram of a device for encoding and decoding according to the invention;

Fig. 2, a schematic illustration of the method according to the invention for pointlike objects;

Fig. 3, a schematic illustration of the method according to the invention for linear objects;

Fig. 4, a schematic illustration of the method

according to the invention for two-dimensional objects;

Fig. 5, a schematic illustration of a method according to the invention for complex objects;

Fig. 6, a first exemplary embodiment of location encoding according to the invention;

Fig. 7, a schematic illustration pertaining to Fig. 6;

Fig. 8, a second exemplary embodiment of location encoding according to the invention; and

Fig. 9, a detail of a digital road map with a decoded object.

The device shown in Fig. 1 comprises a transmitter 1, a transmission system 2, and a receiver 3. The object 21 to be transmitted is provided in an encoder 11 with location references. Both the object 21 itself and the location references are taken from an object database 12 in the transmitter; by way of example, this is a TMC location database. In the encoder 11, with the aid of the object data from the object database 12, a description 22 of the location references of the object 21 to be transmitted is generated. The encoder 11 transfers the object and the location references to the transmission system 2. In the receiver 3, a decoder 31 accepts the object 21 and the description 22 of the location references. From the description 22 of the location references of the object 21, the decoder compares the objects in its object database 32. If the encoder 31 finds an object in the object database 32 with a description of the location references that is quite similar to or identical to the description 22, then the object 21 in the

database 32 is considered to have been referenced.

If, on the basis of the search conditions in the description 22, the decoder 31 finds no reference object with a similar or identical description in the database 32, then  
5 the object 21 is considered to be absent from the database 32.

If the description 22 of the location references includes relational objects which - in contrast to the reference objects - were decodable in the database 32, then  
10 the object 21, with the aid of the description 22, should be inserted into the database 32. For instance, the description 22 includes the location references indicated for transmission in Figs. 2-5.

In the exemplary embodiment of Fig. 2, referencing of  
15 pointlike objects is generated using the following elements:

- geographic position of the reference object RF in the X and Y coordinates, such as WGS84;

- type of reference object;

- geographic position of the relational object as an  
20 offset (differential coordinate) from the reference object in accordance with a defined calculation rule;

- type of relational object.

To avoid ambiguities in dereferencing, the relational object can be selected as

- an element of the traffic route network, such as a  
25

road or street segment or non-digitized entryway, or

- a further reference object, which itself is referenced by the aforementioned criteria, such as park-and-ride lots that have a parking lot and bus or other public transportation stop.

In Fig. 2, as an example, a detail of a map with the two aforementioned objects RF and RL as well as two streets S1 and S2 is shown in the transmitter.

As an example of the receiver database, once again two streets S1 and S2 are selected, and they are shown in highly generalized form. To ascertain an object, in the database 32 (Fig. 1) of the receiver 3, that corresponds to the reference object, a search window SF is created, which then leads to ascertaining a relational object RL'. Next, via the offset dX, dY, the reference object RF' can be found.

In that case, it was possible to find the relational object RL but not the reference object RF. The object RF is therefore entered as a new object in the database 32. If it had not been possible to find the relational object RL unambiguously, either, then no object could be found and entered.

Fig. 3 shows an example for referencing a linear object that extends between two pointlike objects RF1 and RF2. These objects are transmitted to the receiver as reference objects, including the references to a relational object RL and the absolute coordinates X, Y of one of the objects. In the receiver, search windows SF1, SF2 and SF3 are formed, so that in the database of the receiver 3, one relational object RL2' and two reference objects RF1' and RF2' are found. By

means of RF1' and RF2', it is then also possible to decode the linear reference object.

Based on the method for linear objects, two-dimensional objects are encoded via pointlike or linear objects in accordance with Fig. 4, and corresponding differential location coordinates are appended. For each differential location coordinate, a type for the generated or pertinent linear object is additionally indicated. For instance, in accordance with Fig. 4, road segments ST1, ST2, and ST3 are to be encoded, in order to transmit the two-dimensional area enclosed by them. To that end, points of intersection as reference objects RF7, RF8 and RF9 and one relational object RL are selected. The data shown in Fig. 4 are transmitted. In the receiver, search windows SF7-SF10 are created. Inside the search windows, the reference objects RF7'-RF9' and the relational object RL' are then found. The relational object RL' serves as a control, to avoid ambiguities and to enable describing a two-dimensional area as an object, if RF7-RF9 could not be found, while the reference objects RF7'-RF9' serve as points of intersection for the road segments ST1', ST2' and ST3'.

As an example of a complex object, which is composed of a plurality of fragmentary objects of arbitrary functional type, Fig. 5 shows a railroad station BHF, which is meant to have a circular two-dimensional extent and is composed of stops H of various transportation lines and a park-and-ride lot P. The stops H and parking lot P serve as relational objects RL12, RL13, RL14, while a reference object RF10 represents the railroad station per se. A further relational object RL11 is subordinate to the relational object RL14. After the data shown at 2 have been transmitted, search windows are again created, in which the corresponding objects

RL12', RL13', RL14', RF10', and RL11' are found.

This form of transmitting relational objects can also advantageously be utilized if the transmitter forwards the relational objects H and P, for instance, to the receiver so that the receiver can in turn, as a transmitter, send these relational objects in the form of reference objects to a further receiver for decoding. These relational objects then represent referenceable transitional objects between different object databases (such as the road network and the network of public transportation lines).

Fig. 6 shows one example of location encoding - hereinafter also called location description - whose data fields contain the following information. The data field OT (for Object Type) in this example contains a museum M. The position indication POS includes geographical longitude and latitude values. In the case of the example in Fig. 6, the data field at position type POST contains a 0, which means that these location coordinates are located only in the vicinity of an object, or that the coordinates are not navigable. The width of a search window SW is also indicated, in this example as "3", which means that the object is within an area of  $10^3$  m around the location coordinates in the data field POS. Finally, in data field N1, a significant name of the museum is given - in this example "City Museum".

Fig. 7 shows the transmitted position POS, including the search window SW and the encoded location M as it has been found in the search window of the receiver as a result of the search.

A further exemplary embodiment of a location

description according to the invention is shown in Fig. 8, in which the object type is an entryway Z to a museum M. Unlike Fig. 6, in the data field position type POST, a 1 is entered, which means that the location coordinates are navigable. A 2 is entered as the width of the search window. As a designation for the POI, the location description in Fig. 8 contains the term "Uferstraße"; that is, the object "entryway" branches off from Uferstraße.

Fig. 9 shows a detail of a digital road map in which a museum M is encoded. A position P1' transmitted in the data field POS forms the center point of a search window SW'. P1 represents the branching point found for an entryway to the museum M and is ascertained by dropping the plumb line from P1' onto the found object "Uferstraße". The museum and the entryway to the museum have a relationship to one another, which can be encoded and decoded, for instance via the reference/relational object data structure described.

## Claims

1. A method for encoding objects with reference to a traffic route network, wherein the encoded information can also be decoded with the aid of databases that differ from a database used in the encoding, characterized in that the objects are provided with relationships to at least one relational object which is present in databases that are used for the decoding, and the relationships do not primarily result from the traffic route network.

2. The method of claim 1, characterized in that relationships are indicated parallel to a plurality of relational objects.

3. The method of claim 1 or 2, characterized in that relationships are indicated hierarchically to a plurality of relational objects.

4. The method of one of the foregoing claims, characterized in that the relationships are local indications.

5. The method of one of claims 1-3, characterized in that the relationships include logical characteristics, in particular memberships.

6. The method of one of the foregoing claims, characterized in that the information encoded for a respective object (reference object) has the following data structure:

5 <reference object>

<reference/relational object 1>  
     <reference/relational object 11>  
     <reference/relational object 12>  
     ...

10

<reference/relational object 2>  
     ...

<relational object N>, wherein at least the reference object and one relational object are present.

7. The method of claim 6, characterized in that in each case an object with the following data structure is encoded: <reference/relational object>:=

5

<plane>  
     <object type>  
     <object coordinates> <object end>.

8. The method of claim 7, characterized in that the data structure is supplemented with further information, in particular for outputting the object.

5

9. The method of one of claims 6-8, characterized in that data which identify a decoding rule are associated with at least the data of the reference object, and that as needed, data that identify a decoding rule are each associated with the data of the relational objects.

5

10. The method for decoding objects encoded by the method of one of the foregoing claims, characterized in that the at least one relational object is searched for in the database used for the decoding, and thereupon the relationship for the object to be decoded is evaluated.

11. The method of claim 10, characterized in that

search windows are opened around the locations of the relational objects and the reference objects.

12. The method of one of claims 10 or 11, characterized in that the at least one relational object is searched for in at least one further database, if it is not found in the database intrinsically used for the decoding.

5 13. A method for encoding objects with reference to a traffic route network, wherein the encoded information can also be decoded with the aid of databases that differ from a database used in the encoding, wherein the encoding includes at least one position indication, characterized in that the at least one position indication is provided with a position type designator.

14. The method of claim 13, characterized in that the position type designator indicates whether the position indication pertains to an exact position and/or indicates the location of a search space for a position or an object.

15. The method of one of claims 13 or 14, characterized in that the position type designator is valid for one position indication at a time.

16. The method of one of claims 13 or 14, characterized in that the position type designator is valid for a plurality of position indications.

17. The method of one of claims 13-16, characterized in that the position type designator has at least one attribute, which designates further properties of the position indication.

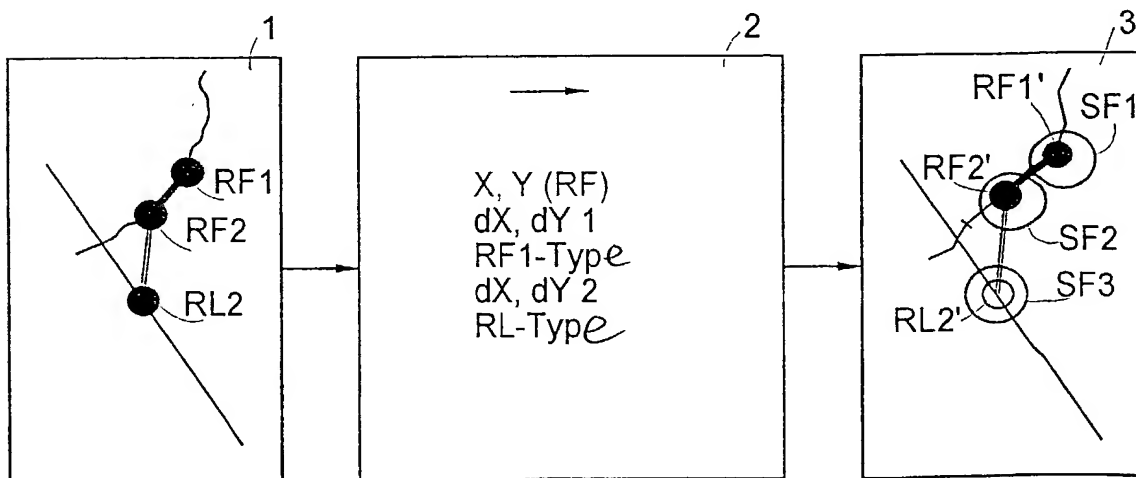
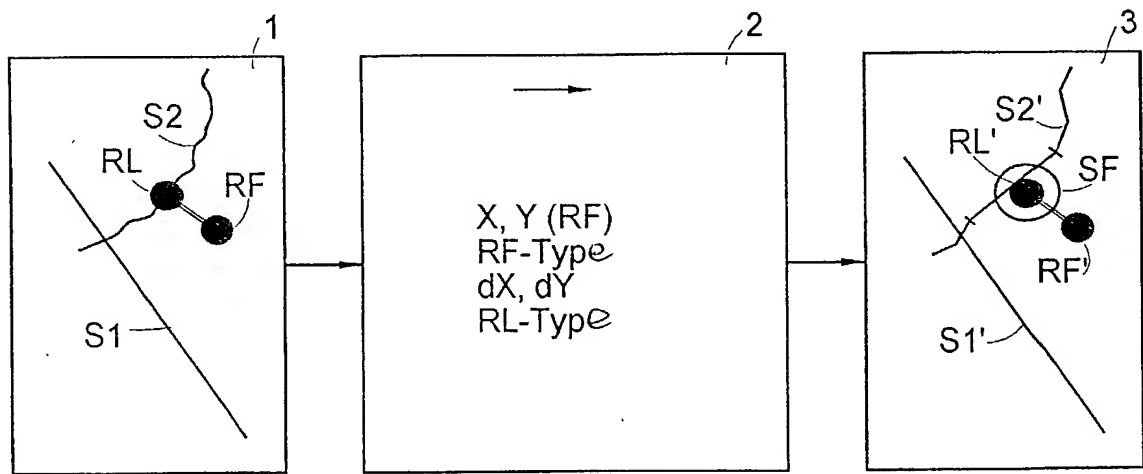
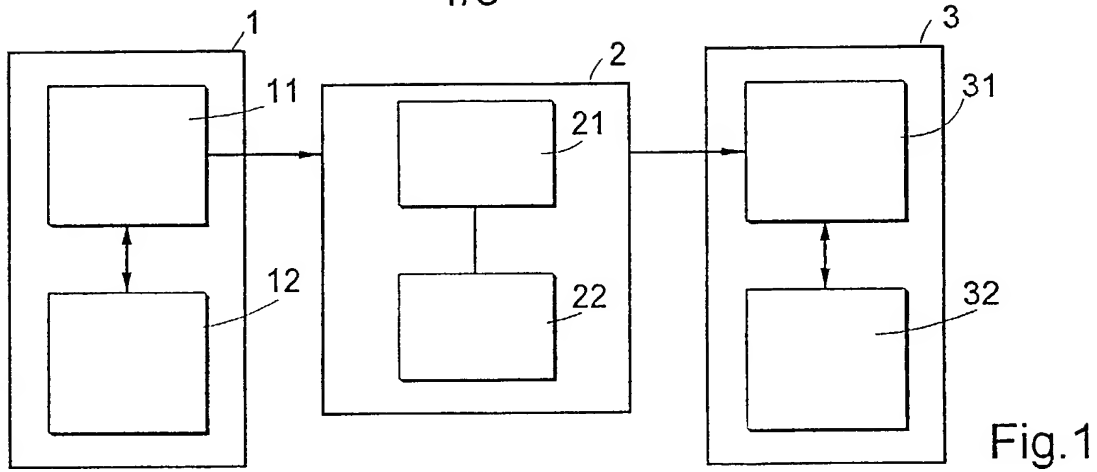
18. The method of claim 17, characterized in that the further properties are an error radius of the position indication.

19. The method of claim 17, characterized in that the at least one attribute indicates whether the position indication is absolute or relative.

## Abstract

In methods for encoding and decoding objects with reference to a traffic route network, wherein the encoded information can also be decoded with the aid of databases that differ from a database used in the encoding, the objects are provided with relationships to at least one relational object which is present in databases that are used for the decoding, and the relationships do not primarily result from the traffic route network. A position indication can also be provided with a position type designator, which for instance indicates whether the transmitted position is an exact or navigable position or is the location of a search space.

1/3



2/3

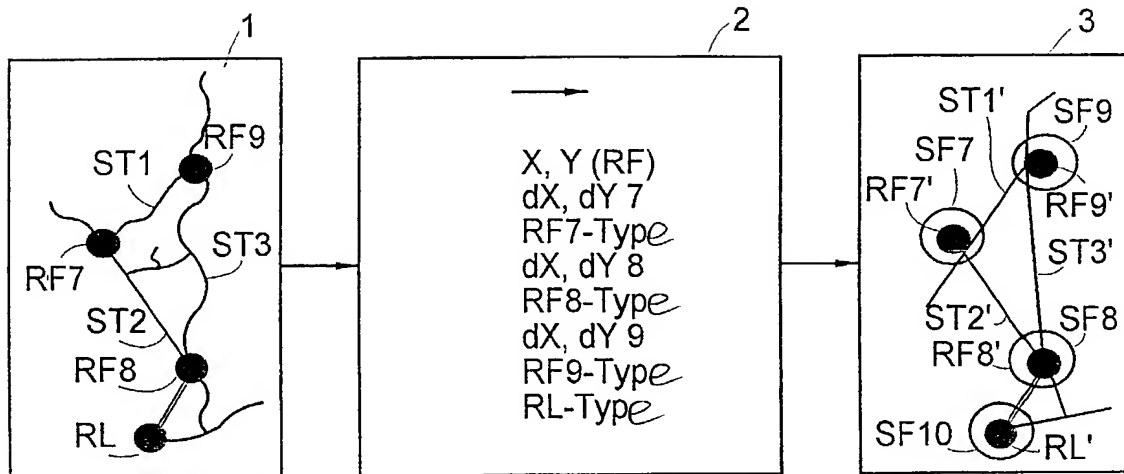


Fig.4

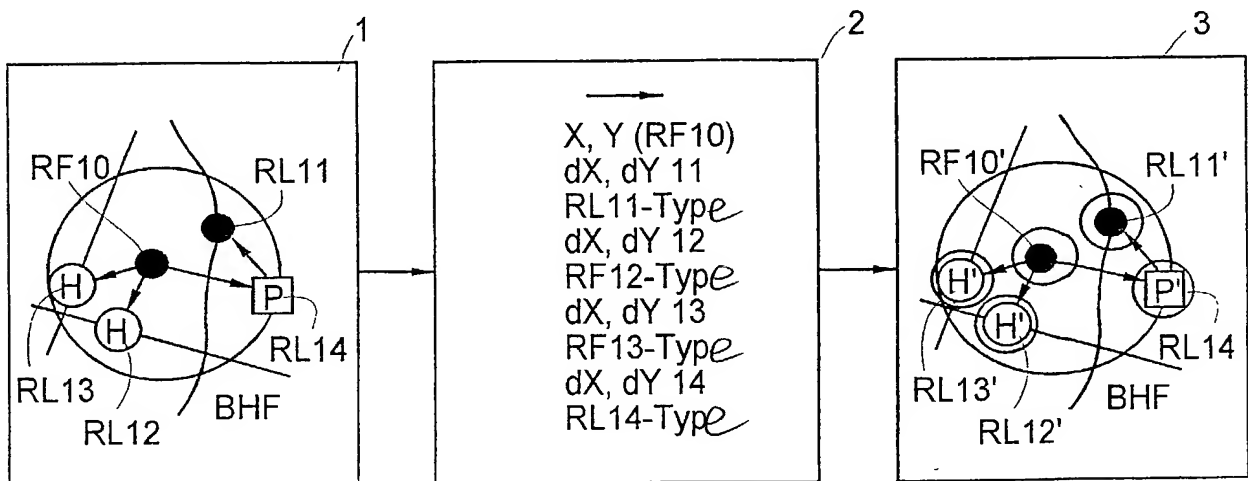


Fig.5

3/3

OT	POS	POST	SW	N1
M	N53°10'04"	O10°30'02"	0 3	"Stadt-Museum"

Fig.6

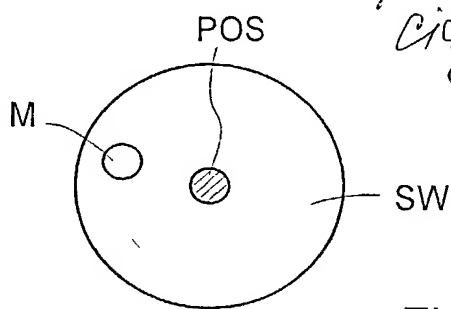


Fig.7

OT	POS	POST	SW	N1
Z	N53°10'04"	O10°30'12"	1 2	"Uferstrasse"

Fig.8

*Bank street*

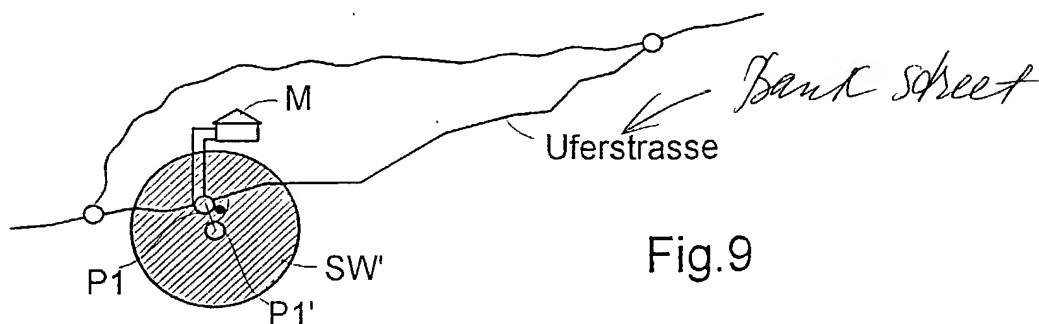


Fig.9

368423K

#4

**DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION**

As a below-named inventor, I hereby declare that:

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Bernd HESSING  
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Gerd DRAEGER

Ulrich KERSKEN  
Peter KREFT  
Jan MARTIN

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD FOR ENCODING AND DECODING OBJECTS WITH REFERENCE TO A TRAFFIC ROUTE NETWORK** the specification of which was filed as PCT International Application number PCT/DE 00/03056 on September 5, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365 (b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):

Priority claimed:

<u>199 42 522.1</u>	<u>GERMANY</u>	<u>SEPTEMBER 7, 1999</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No
<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>                    </u>
(Number)	(Country)	(Date filed)	Yes	No

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with

the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

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